DOCUMENT RESUME

ED 358 929 PS 021 430

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TITLE Theories of AIDS Transmission: Their Development and Implications.
SPONS AGENCY National Inst. of Child Health and Human Development (NIH), Bethesda, Md.
PUB DATE 27 Mar 93
CONTRACT HD27274
NOTE 19p.; Paper presented at the Biennial Meeting of the Society for Research in Child Development (60th, New Orleans, LA, March 25-28, 1993).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Acquired Immune Deficiency Syndrome; *Adolescents; Anxiety; *Attitude Change; *Childhood Attitudes; *Children; Cluster Analysis; *Disease Control; Elementary Secondary Education; Health Education

ABSTRACT

This study examined knowledge of AIDS transmission, attitudes toward interacting with people who have AIDS, and concerns about being personally affected by AIDS in childhood and adolescence. Subjects were 188 children and adolescents ranging from 6 to 18 years old. An open-ended interview covering a wide range of AIDS-related topics was conducted with each child. Participants then completed a structured interview on the same topics, measuring their knowledge of AIDS transmission and attitudes related to AIDS. Cluster analysis indicated that first and second grade children entertained a wide range of hypotheses about the causes of AIDS but also believed that widely-publicized AIDS risk factors and saliva exchange were the most probable causes. With age, children learned more about risky behaviors and weeded out bad ideas until they approximated the accepted scientific theory. Increased knowledge of AIDS causality caused greater willingness to interact with infected individuals and decreased anxiety about being infected. Cluster analysis suggested that distinguishable subgroups of children exist at each age level, each with a qualitatively different theory of HIV transmission. The data suggests that knowing a child's theoretical perspective on AIDS causality allows for better prediction of receptivity to interacting with people who have AIDS. (Contains 28 references.) (MM)

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THEORIES OF AIDS TRANSMISSION: THEIR DEVELOPMENT AND IMPLICATIONS

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*Presented at the biennial meeting of the Society for Research in Child Development, New Orleans, March 27, 1993. This research was partially supported by National Institute of Child Health and Human Development Grant HD27274. We thank Olga Durazo, Cynthia Lewin, and Takayo Mukai for their contributions.

PS 021430

THEORIES OF AIDS TRANSMISSION: THEIR DEVELOPMENT AND IMPLICATIONS

Slowing the spread of AIDS and combatting discrimination against individuals who must live with the disease hinge on providing effective AIDS education, starting in childhood. Providing effective AIDS education, in turn, depends on identifying the beliefs and attitudes that children of different ages bring to the learning situation so that their most serious misunderstandings can be replaced by accurate information. In this paper, we conceptualize children's correct and incorrect beliefs about AIDS transmission as intuitive theories of disease causality, trace the development of such intuitive theories, and explore their implications for the development of attitudes toward AIDS and people who have it.

Most previous studies of children's understandings of disease have been guided by Piagetian theory. Piagetian researchers postulate a series of invariant stages in the development of disease concepts linked to stages of cognitive development (e.g., see Bibace & Walsh, 1980; Burbach & Peterson, 1986; Perrin & Gerrity, 1981; Simeonsson, Buckley, & Monson, 1979). They describe a developmental shift from vague, magical, and illogical thinking to the identification of concrete, external causes of disease and ultimately to more abstract, physiological theories of disease causality--a sequence that appears to characterize the development of understandings of AIDS (Cuddy, Frame, and Whitt, 1991; Walsh & Bibace, 1991).

Valuable as this research has been, it can also be faulted. Here we highlight one critical limitation of the Piagetian approach: it focuses on the form or complexity of thinking apart from its accuracy. Using either of the most popular systems for scoring levels of conceptualization of disease--the Bibace and Walsh (1980) system or the Perrin and Gerrity (1981) system--requires ignoring the accuracy of children's ideas; a flatly incorrect theory should be scored at the highest conceptual level so long as it is causally complex. Because children's theories can be scientifically correct or incorrect at any of the levels, Piagetian research has had little to say about the content of children's thinking about AIDS or any other disease.

Unfortunately, most other information about children's understandings of disease has been obtained from testlike surveys guided by no theory at all. Such tests implicitly assume that children's knowledge of disease consists of isolated bits of information; the possibility that children construct coherent, organized theories of disease is neglected. In searching for a more promising conceptual framework to guide our research on the development of children's understandings of AIDS, we looked to theoretical perspectives that view knowledge as structured and that view conceptual development as driven by the acquisition of knowledge in a domain rather than by stagelike cognitive maturation.

Some "knowledge base" approaches would characterize the development of knowledge of disease as a novice-to-expert shift in response to the accumulation of information (e.g., see Chi & Ceci, 1987). Even more attractive, though, is the work of theorists such as Susan Carey (1985, 1991) and Frank Keil (1989), who emphasize that young children's understandings are theory-like in nature, organized around causal principles. As children acquire additional information in a domain, their initial intuitive theories might either become more specific and differentiated, as Keil tends to maintain, or give way to fundamentally different theories, as Carey argues. From either perspective, children's beliefs about disease--both accurate and inaccurate--would be embedded in a coherent conceptual structure.

It has not proven easy to characterize children's intuitive theories of physical and biological phenomena or to describe developmental changes in such theories (see, for example, Novak & Musonda, 1991). In this paper, we explore the utility of cluster analysis as a methodology for characterizing theories of AIDS transmission. Cluster analysis allows one to identify groups of children ("theoretical camps") whose ideas about what can and cannot cause AIDS are distinctive.

Earlier work suggests that children's theories about AIDS transmission change substantially with age. In our own study of knowledge of risk factors for AIDS, colds, and cancer among fourth, sixth, and eighth graders and college students, the main developmental trend was toward increased differentiation between true and false risk factors for each disease, as well as between risk factors for one disease and risk factors for another (Sigelman, Maddock, Epstein, & Carpenter, 1993). The youngest children studied, 9- to 10-year-olds, were as knowledgeable as college students about the primary risk factors for AIDS but held many more misconceptions about risks associated with kissing, sharing drinking glasses, and other activities involving saliva exchange, as well as about the dangers of drug use. Other studies also suggest that misconceptions centering on saliva exchange are common among elementary school children and become less widespread with age (Brown, Nassau, & Barone, 1990; Fassler, McQueen, Duncan, & Copeland, 1990; Glenister, Castiglia, Kanski, & Haughey, 1990). It seems likely, then, that children's earliest theories of AIDS are infectious disease theories that view as potentially risky any behavior that involves close contact with an infected person--particularly behavior that results in internalizing bodily fluids. Given their experience with childhood illnesses, it would be natural for children to assume that an unfamiliar disease is, first of all, infectious rather than noninfectious, and, in addition, easily spread from one person to another in all the ways that familiar diseases such as colds and flus are spread.

Quite different intuitive theories of AIDS might be formulated by children who hear, through the media and elsewhere, that it is spread through drug use, sex, and contact with blood. Many children have mistakenly concluded that AIDS can be transmitted through such low-risk, drug-related activities as cigarette smoking and sharing marijuana cigarettes (Lindauer, Schvaneveldt, & Young, 1989; Sigelman et al., 1993). Similarly, many infer, presumably based on messages about the dangers of blood exchange, that blood donation or any contact with needles is risky (Brown et al., 1990; Fassler et al., 1990).

If children construct intuitive theories about the causes of AIDS, how might these theories be linked to their attitudes toward AIDS and people with AIDS? Complexity of thinking about disease, as conceptualized by Piagetian researchers, does not appear to be strongly related to attitudes. For example, Cuddy et al. (1991) found no indication that advances in complexity of thinking about AIDS between kindergarten and fifth grade were paralleled by increasingly favorable attitudes toward people with AIDS, although a developmental increase in understanding of cancer was accompanied by a developmental increase in acceptance of peers with cancer. Upon reflection, there is no compelling reason to hypothesize that complex causal reasoning about disease should breed enlightened attitudes. Far more relevant, it would seem, is the content of the child's thinking about disease. More specifically, it seems likely that children who have constructed an undifferentiated theory of AIDS transmission, citing numerous factors associated with both infectious and noninfectious disease as causes of AIDS, and children who subscribe to an infectious disease model in which AIDS is transmitted as the common cold is transmitted should be more likely than those who have acquired an accurate theory, or even

those who have formulated a theory emphasizing any kind of drug use as the cause, to fear contact with infected individuals and to worry inordinately that they or their loved ones might fall prey to the disease.

Reasonable as this argument may seem, previous research, primarily with adolescents, provides only mixed support for the view that knowledge about AIDS predicts attitudes surrounding AIDS. In a survey of high school students, for example, Skurnick, Johnson, Quinones, Foster, and Louria (1991) found that students who knew that AIDS cannot be spread through casual contact were less likely than students who believed casual contact myths to express concerns about interacting with persons with AIDS. However, the relationship was far from perfect; for example, 56% of those who knew that AIDS cannot be spread by toilet seats nonetheless said that they would be afraid to share a bathroom with a person who has AIDS. Ignorance is apparently not the only source of reluctance to interact with infected individuals (see also Brown & Fritz, 1988).

Similarly mixed evidence was obtained by Zimet, Hillier, Anglin, Ellick, Krowchuk, and Williams (1991). Although adolescents who knew someone with AIDS were less anxious than adolescents who did not about interacting with infected individuals, they scored no higher on a test of AIDS knowledge. Correlational analyses revealed positive relationships between accurate knowledge of AIDS and low anxiety about interacting with people with AIDS and about contracting AIDS, but the relationships were weak. Sometimes such correlations are not even significant (Brown & Fritz, 1988). Moreover, attitudes sometimes become more tolerant in response to AIDS education (Brown, Fritz, & Barone, 1989; Huszti, Clopton, & Mason, 1989), but sometimes do not (Rickert, Gottlieb, & Jay, 1990; Rickert, Jay, & Gottlieb, 1991).

Despite only weak evidence of a relationship between AIDS knowledge and attitudes among adolescents, however, there is reason to expect the knowledge-attitude relationship to be stronger among elementary school children. Most adolescents have a fundamentally correct understanding of AIDS transmission, whereas many more children are convinced that AIDS can be spread through the sorts of contacts that transmit colds and flus and should therefore be reluctant to interact with infected individuals for that eminently rational reason. Surveying fifth, seventh, and tenth graders about AIDS, Brown, Nassau, and Barone (1990) found knowledge about AIDS and tolerance toward people with AIDS to increase, and worry about getting AIDS to decrease, across age groups. In addition, McElreath and Roberts (1992) reported a correlation of .47 between elementary school children's knowledge of AIDS and their attitudes toward people with AIDS.

In this study we examine knowledge of AIDS transmission, attitudes toward interacting with people who have AIDS, and concerns about being personally affected by AIDS in childhood and adolescence, as well as linkages between knowledge and attitudes. Building on the work of Carey and Keil, we assume that children organize information they acquire about AIDS, as well as stored knowledge of other diseases, into meaningful theories of AIDS causality. We hypothesize that: (1) their initial intuitive theories will be relatively undifferentiated and will reflect faulty inferences based either on application of a general infectious disease model of illness to AIDS or on overgeneralization of AIDS-specific information about the dangers of drugs, sex, and blood; (2) with age, children's theories will become more accurate, differentiating more sharply between true and false risk factors; (3) adherence to a global, undifferentiated theory or a general infectious disease theory will be more strongly associated than will belief in other

theoretical views with an unwillingness to interact with persons with AIDS and with worry about being personally affected by AIDS; and (4) knowing a child's intuitive theory of AIDS causality will increase the ability to predict his or her attitudes over and above what can be predicted based on age alone.

Method

Participants

The base sample for this study consisted of 188 children and adolescents ranging in age from 6 to 18. They were recruited from 10 after-school care and recreational facilities in a southwestern city. Parent consent forms were given to parents or sent home with children; the return rate was 33%, and it should therefore be borne in mind that this is a volunteer sample not necessarily representative of the larger community. However, the sample was ethnically and socioeconomically diverse. Overall, 50% were female; 66.0% were non-Hispanic whites, 16.5% Hispanics, 11.7% blacks, and 5.8% Asian, Native-American, or other ethnic background; and their consenting parents' years of education ranged from 10 to 18 (M = 14.8).

Measures

Each child was interviewed first with an open-ended interview schedule covering a wide range of AIDS-related topics. Participants then completed a structured interview on the same topics, elementary school students usually a day or two after their open-ended interviews, secondary school students typically the same day. The measures of primary interest here were derived primarily from the structured interview.

Knowledge of AIDS Transmission. Children responded to a section describing 32 behaviors and asking them about the chances that each behavior could transmit AIDS (0 = no chance, 1 = very little chance, 2 = pretty good chance, 3 = big chance). Based on preliminary factor analyses and internal consistency analyses, we formed eight specific risk factor subscales, each a mean endorsement score ranging from 0 to 3: (1) Sex and IV Drugs (4 items involving sharing drug needles or engaging in high-risk sexual behavior, alpha = .74), (2) Risky Blood (4 items including becoming blood brothers or sisters and being born to an infected mother, alpha = .69); (3) Airborne (2 items involving being breathed on or sneezed and coughed on by a person with AIDS, alpha = .82; (4) Saliva (3 items--kissing, sharing a drinking glass, sharing a marijuana cigarette, alpha = .87); (5) Contact/Proximity (6 items covering touching, hugging, and sitting near as well as indirect contacts such as using the same toilet seat or eating at a restaurant where the cook has AIDS (alpha = .85); (6) Low-Risk Drugs (4 items concerning smoking, drinking, and solo drug use, alpha = .88); (7) Low-Risk Blood (4 items, including blood donation and being bitten by a mosquito that bit someone with AIDS, alpha = .57); and (8) Magic (2 items about whether not believing in God or stealing and lying a lot cause AIDS).

For purposes of cluster analysis, risk subscale scores were converted to z scores, as the relative influences of dimensions in a cluster analysis are affected by their variances and standardized scoring equalizes variances. In addition, the airborne transmission, saliva, and contact/proximity risk factor subscale scores were averaged, yielding a Cold Risks subscale (11 items, alpha = .92). This was done because these scales were conceptually similar and highly

intercorrelated, therefore contributing redundant information to the cluster analysis.

Attitude Measures. The first measure of attitudes surrounding AIDS was a social distance measure, Willingness to Interact, consisting of 10 items asking whether children would definitely, probably, probably not, or definitely not engage in such behaviors as sitting next to, touching, kissing, and drinking from the same glass as someone with AIDS, as well as whether they would avoid or treat normally a teenager they knew who turned out to have AIDS and would be receptive to interacting with a nurse or doctor who treats someone with AIDS and a teacher and classmate who have AIDS (alpha = .86). Two items were reverse scored such that total scores could range from 0 to 30 and high scores indicated willingness to interact. The second measure, Worry about AIDS, consisted of three items about the degree to which a child worried that he/she, a family member, or a friend might get AIDS (not at all, a little, some, a lot). Scores could range from 0 to 9, maximum anxiety (alpha = .80).

Results

We present first descriptive data concerning age group differences in beliefs about how AIDS is and is not transmitted, as well as in attitudes surrounding AIDS. Then we present the cluster analysis findings, centering on the beliefs about AIDS transmission that distinguish between the resulting theoretical camps of children, the demographic characteristics of members of each theoretical camp, and the implications of theoretical intuitions about AIDS transmission for attitudes.

Age Group Differences in Endorsement of Risk Factors

Table 1 reports means for five age groups (grades 1-2, 3-4, 5-6, 7-9, and 10-12) in endorsement of the eight specific types of potential risk factors. Age Group x Sex ANOVAs revealed age group differences on all eight subscales. The general pattern is one of sharper differentiation with age between true risk factors (items concerning IV drug use or sex and risky blood exchanges) and false risk factors; true risk factors are more strongly endorsed, false risk factors are more decisively rejected.

Insert Table 1 about here

Follow-up Tukey's tests ($p < .05$) indicated that first and second graders often distinguished themselves from other age groups: they were significantly less likely than the three oldest groups to endorse IV drug use and sex as causes of AIDS, and significantly more likely than all other groups, including 3rd and 4th graders, to believe in transmission through the air, through contact with or even proximity to an infected person, through non-risky drug use, and through low-risk, blood-related activities such as donating blood. The most widespread and tenacious misconception among elementary school children was the belief that AIDS can be transmitted through saliva exchange. As for adolescents, junior and senior high school students did not differ significantly from each other in knowledge; both groups has basically accurate theories of AIDS transmission, though both clung to some saliva myths and blood-related myths.

Although it is clear that differentiation between classes of risk factors increases with age, we should not lose sight of the fact that even first and second graders have specific intuitions about what causes AIDS. Indeed, their intuitions are clearly on the right track in that they tend

to believe that IV drug use and sex cause AIDS and to reject the magical idea that bad behavior, through a kind of immanent justice, can result in HIV infection. Their intuitions about the dangers of saliva exchange are reasonable inferences based on an infectious disease model of disease transmission, not at all unlike what many adults have inferred (and often still infer) about AIDS transmission.

At the same time, these young children hold many potentially fear-provoking misconceptions. Of these first and second graders, 80% believe that there is a pretty good chance or a big chance that AIDS can be spread by sharing IV drug needles; 77% believe that there is a pretty good or big chance it can be caught by sharing a drinking glass with a person with AIDS, 72% by smoking cigarettes and 60% by getting drunk a lot, 55% by being sneezed on by an infected person, 43% by touching a person with AIDS who has sweaty skin, and 37% by donating blood.

Sex differences in beliefs about AIDS transmission were minimal. The main effect of gender was never significant in the ANOVAs, and the interaction between gender and age group was significant for only two subscales. First and second grade girls were somewhat more likely than boys their age (2.30 vs. 1.81, $p < .06$) to endorse IV drug use and sex as AIDS risk factors, although the sexes did not differ at other age levels. Junior high school boys were more likely than junior high school girls to believe in the possibility of airborne transmission (.62 vs. .12, $p < .01$).

Table 1 also reveals that willingness to interact with people who have AIDS increased substantially with age, F (4, 167) = 27.88, $p < .0001$. First and second graders were less willing to have contact with infected individuals than all older age groups were, and 3rd-4th and 5th-6th graders were less willing than both junior and senior high school students. A significant interaction between age group and sex was also obtained, F (4, 167) = 3.09, $p < .05$; F tests for simple effects revealed that 1st/2nd grade girls were less willing to interact than 1st/2nd grade boys (6.88 vs. 13.11, $p < .05$), but that senior high school girls were more willing to interact than senior high school boys (23.58 vs. 20.21, $p < .05$). As a result, age differences were stronger among females than among males, though they were significant for both sexes.

Finally, worry about being personally affected by AIDS decreased with age, F (4, 171) = 6.09, $p < .0001$, with 1st and 2nd graders worrying more than junior and senior high school students that they, their family members, or their friends might get AIDS. No sex differences in degree of AIDS anxiety were evident. In sum, these descriptive analyses reveal substantial gains with age in knowledge of what does and does not cause AIDS, accompanied by greater receptivity to interacting with people who have the disease and reduced concern about being personally affected by it.

Cluster Analysis to Identify Theoretical Camps

Clusters were generated using Ward's method, which seeks to minimize squared Euclidean distances between individuals within clusters and were performed on z scores. A five-cluster solution was judged optimal in that it captured important distinctions among children in thinking about the causes of AIDS without introducing trivial distinctions. Table 2 presents, for each cluster, mean raw scores on each of the six risk factor subscales used in the cluster analysis; scores can range from 0 (no chance) to 3 (big chance of transmission). ("Cold Risks"

is the average of the saliva, airborne transmission, and contact/proximity scales). The five clusters can be characterized as follows:

Table 2 about here

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(1) Magical Thinking: These 14 children were about average in their endorsement of true risk factors (sex/IV drugs and risky blood) and scored above average on all four scales measuring misconceptions. They were the only group to endorse at all the magical notion that being irreligious or stealing and lying can cause AIDS. Basically, these individuals had an undifferentiated view of AIDS causality; they believed that almost anything, not just behaviors associated with the transmission of infectious diseases, can cause it.

(2) Doubt True/No Clue: These 26 children were less likely than most students to view sex and drug needle sharing, and to a lesser extent risky blood contact, as causes of AIDS, even though they endorsed these true risk factors more than the false ones. They were typically near the sample mean on the four transmission myth scales, suggesting that they are not sure what causes AIDS or believe that it is difficult to get.

(3) Drugs and Germs: These 37 students were fairly average in their endorsement of true AIDS risk factors. Their distinguishing feature was their strong sense that drug use of any sort (not IV drug use in particular) and behaviors that can spread germs and cause colds and other readily infectious diseases cause AIDS. Thus they were not as indiscriminate in their beliefs as the Cluster 1 magic thinkers were, and they had stronger intuitions than the Cluster 2, No Clue, children did. They seem to have drawn on their experience with familiar infectious diseases to conclude that behaviors that transmit colds also transmit AIDS, but they also appear to have overgeneralized the dangers of sharing drug needles to other drug-taking behaviors, including those that do not involve internalizing an infected person's germs.

(4) Sex and Drugs/Not Blood: The 55 students in this cluster had a basically accurate view of AIDS transmission. Although their level of endorsement of sex and IV drug sharing was not unusually high, and they were somewhat below average in their endorsement of blood-related risk factors, they firmly rejected most myths about AIDS transmission, as evidenced by below-average means on the four myth subscales.

(5) True Risks (with Blood Myths): Finally, a fifth cluster of 53 students also had a basically correct view of AIDS causality. Members of Cluster 5 distinguished themselves from members of Cluster 4, however, by their stronger endorsement of both true risk factor subscales (sex/drugs and risky blood) and their less decisive rejection of non-risky blood contacts as causes of AIDS. It is as if they had more fully assimilated messages about the dangers of blood but had overgeneralized these messages.

Not surprisingly, a 5 (Cluster) X 6 (Risk Factor) ANOVA on the raw means revealed significant differences between the five clusters of respondents, F (4, 180) = 91.76, $p < .0001$; greater endorsement of true than false risk factors overall, F (5, 900) = 464.67, $p < .0001$; and an interaction effect indicating that the five groups endorsed risk factors differentially, F (20, 900) = 51.85, $p < .0001$. It is important to note that all five groups of children, despite their theoretical differences, endorsed true risk factors at least somewhat more strongly than false risk factors.

Based on the cluster analysis results, one might hypothesize that members of Clusters 1, 2, and 3 are younger than members of Clusters 4 and 5, and that Cluster 1 magical thinkers are the youngest of all. Moreover, because members of Clusters 1 and 3 believe that there are many ways to get AIDS, including ways that involve only casual contact, one would expect them to be less willing to interact with people who have AIDS and more worried that they or their significant others will get AIDS than members of Clusters 2, 4, and 5 are.

Demographic Characteristics of Children in the Five Groups. Table 3 presents the demographic characteristics of the five clusters of students. An ANOVA for age differences, followed up by a Tukey's test, revealed that Clusters 1, 2, and 3, were all younger than Clusters 4 and 5, F (4, 179) = 41.58, $p < .0001$. Although magical thinkers were indeed the youngest group, they were not significantly younger than members of Clusters 2 and 3.

Insert Table 3 about here

The grade level distributions in Table 3 clarify the relationship between age and theoretical perspective by indicating the percentages of children within each age group falling in each cluster. Over half of first and second graders were Cluster 3 drug and germ theorists. The rest were either Cluster 1 magical thinkers or Cluster 2 members with no strong intuitions about AIDS causality. None had an accurate theory of AIDS transmission. Middle elementary school appears to be an important transitional period, as all five theoretical camps were well-represented among 3rd and 4th graders. The shift from the three immature theories to the two more accurate theories continued in 5th and 6th grade, and, by junior high school, all but a few students held basically accurate, Cluster 4 or 5, theories of AIDS transmission.

Table 3 also indicates that the distribution of minority group children across clusters was not significantly different from the distribution of non-Hispanic white children, as indicated by a chi-square test. Similarly, males were no more likely to fall in one theoretical camp or another than females were. Age, then, is the individual characteristic most predictive of cluster membership.

Implications of Transmission Theories. Finally, Table 4 speaks to the implications of theories of AIDS transmission for attitudes. Willingness to interact with people who have AIDS differed significantly across clusters, F (4, 172) = 28.73, $p < .0001$. Cluster 1 magical thinkers were the least willing to interact with people with AIDS, less willing than all but the Cluster 3 drug and germ theorists. Cluster 2 (no clue) children were significantly more willing to interact than Cluster 1 but not Cluster 3 members, and knowledgeable Cluster 4 and 5 members were more willing to interact with people who have AIDS than all three younger, less knowledgeable groups.

Insert Table 4 about here

The pattern of group differences in self-reported worrying about being affected by AIDS was similar but not as sharp, F (4, 176) = 3.71, $p < .01$. Cluster 1 magical thinkers were the most worried, and knowledgeable Cluster 4 and 5 members were significantly less worried. Members of Cluster 2 and 3 were intermediate, not different from either the magical thinkers or those who subscribed to accurate transmission theories.

Because of the strong relationship between age and cluster membership, we repeated these analyses of variance with age entered first as a covariate. The goal was to determine whether cluster membership continues to predict attitudes even with age differences between clusters controlled. The second part of Table 3 presents the adjusted means. In the analysis of willingness to interact with people who have AIDS, the effects of both age and cluster membership were significant, F (1, 170) = 104.69, $p < .0001$, for age, F (4, 170) = 9.49, $p < .0001$, for cluster. The rankings of the five groups remained the same after means were adjusted for age, but the difference between Cluster 1 magical thinkers and Cluster 3 drug and germ theorists became significant, making Cluster 1 members less inclined to have contact with HIV-infected persons than all other groups. Age and cluster membership jointly accounted for 46% of the variance in willingness to interact.

The analysis of covariance for worry revealed a significant effect of age, F (1, 174) = 20.62, $p < .0001$; however, even though Cluster 1 magical thinkers tended to worry the most, cluster membership had no predictive value of its own once the effect of age was removed. Jointly age and cluster membership accounted for 13% of the variance in worry. AIDS-related worrying, then, was less predictable than desired social distance from people who have AIDS and seemed to have less to do with a young child's specific theory of AIDS transmission than with the fact that he or she is a young child.

Discussion

Based on these preliminary findings, and bearing in mind that cluster analyses involve subjective judgment and require replication, we believe that cluster-analytic techniques have something to contribute to the study of children's concepts of disease. Cluster analysis allows one to identify homogeneous groups of children on the basis of their distinctive patterns of belief about disease causality--or, for that matter, about any aspect of disease. It facilitates efforts to supplement Piagetian assessments of the complexity of children's thinking about disease with characterizations of the substance of that thinking. Moreover, it supports attempts to conceptualize the child's knowledge of disease, not as a collection of isolated facts and misconceptions, but as a theory-like set of propositions.

The present analyses indicate that first and second grade children entertain a wide range of hypotheses about what causes AIDS but also believe that widely-publicized AIDS risk factors and saliva exchange are the most probable causes. With age, children learn more about risky behaviors and weed out more and more bad ideas until they approximate the accepted scientific theory. With increased knowledge of AIDS causality comes greater willingness to interact with infected individuals and decreased anxiety about the possibility that self, family, or friends could be infected. So far, this description of development is largely consistent with that conveyed by previous research on AIDS (e.g., Brown et al., 1990; Sigelman et al., 1993).

What, then, does cluster analysis add to the picture? First, it suggests that there are distinguishable subgroups of children at any age level, each with their own, qualitatively different theory of HIV transmission. We had expected that we might find two competing theoretical schools among elementary school children: some children, perhaps largely oblivious to coverage of AIDS, with an infectious disease theory of AIDS based on their experience with colds and other common illnesses, and other children, perhaps heavily exposed to information about AIDS, who recognize the dangers of true AIDS risk factors but mistakenly view low-risk

drug-taking and low-risk contact with blood as risky too. Instead, we found one group of elementary school children that viewed virtually any behavior, whether or not it is likely to transmit germs from person to person, as a potential cause of AIDS; a second group unsure what to view as risky; and a third group blending AIDS-specific information and information about familiar infectious diseases into a hybrid theory emphasizing true AIDS risk factors, saliva exchange, and all types of drug abuse.

It might be argued that contrasting response biases could account for the tendency of Cluster 1 members to endorse many risk factor items and Cluster 2 members to endorse few. However, this possibility becomes less plausible when we consider that the Cluster 1 magical thinkers who agreed so readily with the risk factor items had to disagree with eight out of ten of the social distance items to register their unwillingness to interact and that the Cluster 2 children who endorsed few risk factor items agreed with many willingness to interact items. We believe, then, that the difference between Cluster 1 magical thinkers and Cluster 2 clueless thinkers is more than an artifact of response bias--that some elementary school children genuinely believe that AIDS is caught in numerous ways, including ways not typically associated with the spread of infectious disease, whereas other children believe that AIDS is very difficult to get.

It is not clear from these data whether one or another theory of AIDS transmission is developmentally prior to others--is likely to be a child's first guess, upon hearing of AIDS, about how one gets it. Extensions of the present research to preschool children might answer that question. It is possible, of course, that the three less developmentally mature clusters detected in this sample would emerge as competing theories even among younger children. However, in the open-ended interviews we conducted, many first and second graders spontaneously mentioned sharing food, kissing, and the like when asked how someone might get AIDS, suggesting that saliva exchange is an especially popular theory at that age.

The present data also suggest that knowing a child's theoretical perspective on AIDS causality allows one to predict--better than one can based on age alone--receptivity to interacting with people who have AIDS. More specifically, reluctance on the part of children to interact with HIV-infected individuals appears to derive rather straightforwardly from a belief that AIDS can be contracted in numerous ways. Summary correlations between overall knowledge of AIDS transmission and willingness to interact with HIV-infected individuals were significant at all grade levels but decreased in strength with age, from .75 among first and second graders to .57 among third and fourth graders, .52 among fifth and sixth graders, .38 among seventh to ninth graders, and .39 among tenth to twelfth graders. These correlations are in line with McElreath and Roberts's (1992) correlation of .47 between the AIDS knowledge and attitude scores of fourth to sixth graders.

Among adolescents and adults, the knowledge-attitude relationship is probably not as straightforward, and this may help explain why knowledge-attitude correlations tend to be lower than they are in child samples. For adolescents and adults, negative attitudes toward interacting with HIV-infected people most likely serve the symbolic function of expressing disapproval of homosexuality as well as the more practical or instrumental function of protecting against HIV infection (see Pryor, Reeder, Vinacco, & Kott, 1989). In addition, adolescents and adults display an almost irrational unwillingness to associate with HIV-infected individuals, even when they know full well that the HIV virus cannot be transmitted through casual contact (Brown & Fritz,

1988; Skurnick et al., 1991; and see Rozin, Markwith, & Nemeroff, 1992, on the magical laws of contagion as in relation to reluctance to have contact with the belongings of a person with AIDS). Further research is needed to determine the extent to which attitudes toward people with AIDS serve instrumental or symbolic functions at different ages; to assess changes in the strength of knowledge-attitude relationships across age groups; and to clarify when an individual's intuitive theory of the causes of a disease does or does not have implications for his or her orientation toward victims of the disease.

Cluster membership in this study was less closely associated with concern that self, family member, or friend would become HIV-infected and the independent effect of cluster membership disappeared once the effect of age was taken into account. We suspect that greater worrying on the part of children than adolescents has less to do with their theories of AIDS transmission--and certainly less to do with their actual odds of becoming HIV-infected in the imminent future--than with differences in their willingness to admit to fearfulness or in their sense of control over their fates. Regardless of age, worry or concern about disease is also likely to be related to the individual's level of generalized anxiety (see Brodie, 1974; Gochman & Saucier, 1982).

Theoretically, our findings suggest that the development of knowledge of AIDS and other diseases can be construed as a process of formulating and reformulating intuitive theories; the challenge that remains is to further delineate the nature and evolution of these naive theories. Practically, these data constitute strong evidence in favor of earlier and more aggressive AIDS education than is currently being provided, ideally education based on a careful analysis of children's existing beliefs and the broader theories in which they are embedded, education that seeks to replace faulty intuitions with sound ones. It is abundantly clear that young children today are assimilating information (or misinformation) about AIDS and that they are constructing theories of AIDS transmission that are dangerously inaccurate. Children will remain deeply fearful of AIDS victims so long as they believe that the disease can be passed through a sneeze or a touch; they will continue to view the world as a dangerous place indeed if they also believe that smoking cigarettes, being bitten by mosquitoes, and not believing in God can cause AIDS. It is time that we talked to them.

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Table 1. Age Group Differences in Mean Transmission Knowledge and Attitude Scores

	Age Group				
	1st-2nd	3rd-4th	5th-6th	7th-9th	10th-12th
Risk Factor Subscales					
Sex & IV Drugs	2.13_{a}	2.25_{ab}	2.53_{bc}	2.56_{bc}	2.76_{c}
Risky Blood	1.88_{a}	1.99_{ab}	2.18_{ab}	2.27_{ab}	2.31_{b}
Airborne	1.67_{a}	1.07_{b}	$.92_{b}$	$.35_{c}$	$.27_{c}$
Saliva	1.97_{a}	1.63_{a}	1.65_{a}	$.74_{b}$	$.45_{b}$
Contact/Proximity	1.45_{a}	$.71_{b}$	$.60_{bc}$	$.36_{c}$	$.32_{c}$
Low-Risk Drugs	1.83_{a}	$.99_{b}$	$.87_{b}$	$.21_{c}$	$.08_{c}$
Low-Risk Blood	1.32_{a}	$.87_{b}$	$.88_{b}$	$.81_{b}$	$.70_{b}$
Magical	$.71_{a}$	$.31_{ab}$	$.06_{b}$	$.14_{b}$	$.00_{b}$
Attitudes					
Willing to Interact	9.04_{a}	13.94_{b}	15.19_{b}	20.33_{c}	21.96_{c}
Worry about AIDS	6.45_{a}	5.11_{ab}	5.13_{ab}	4.25_{b}	3.62_{b}

Note: Means in each row that do not share a subscript in common are significantly different ($p < .05$). Risk scales range from 0 to 3; willingness to interact scores from 0 to 30; and worry scores from 0 to 9.

Table 2. Mean Endorsement of True and False Risk Factors by Cluster Membership

	Cluster				
Risk Factors	1	2	3	4	5
Sex & IV drugs	2.46_a	1.51_b	2.51_a	2.58_a	2.83_c
Risky blood	2.13_a	1.85_a	1.94_a	1.97_a	2.65_b
Cold risks	1.98_a	1.05_b	1.59_a	$.30_c$	$.57_d$
Low-risk drugs	2.09_a	$.74_b$	1.75_a	$.12_c$	$.16_c$
Low-risk blood	1.70_a	$.81_{bc}$	1.12_c	$.49_b$	$.96_c$
Magic	2.11_a	$.25_b$	$.08_{bc}$	$.00_c$	$.00_c$

Cluster 1 = Magical Thinking
Cluster 2 = Reject True/No Clue
Cluster 3 = Drugs & Germs
Cluster 4 = Sex & Drugs/Not Blood
Cluster 5 = True Risks/Blood Myths

Table 3. Demographic Characteristics of the Clusters

	Cluster				
	1	2	3	4	5
Mean age	8.36_a	9.19_a	8.65_a	13.57_b	13.62_b
1st-2nd grade	20.0%	26.7%	53.3%	0.0%	0.0%
3rd-4th	16.2	27.0	27.0	13.5	9.4
5th-6th	3.2	29.0	29.0	25.8	15.1
7th-9th	2.8	5.6	2.8	50.0	38.9
10th-12th	0.0	3.9	2.0	43.4	51.0
Minority	9.8%	14.7%	23.0%	19.7%	32.8%
Anglo	6.5	13.7	18.5	34.7	26.6
Female	5.5	17.6	20.9	26.4	29.7
Male	9.7	10.8	19.4	32.3	28.0

Note: Percentages in each row add to 100%.

Cluster 1 = Magical Thinking
Cluster 2 = Reject True/No Clue
Cluster 3 = Drugs & Germs
Cluster 4 = Sex & Drugs/Not Blood
Cluster 5 = True Risks/Blood Myths

Table 4. Willingness to Interact and Worry about AIDS by Cluster Membership

	Cluster				
	1	2	3	4	5
	Unadjusted means				
Willing to interact	7.42_{a}	13.13_{b}	12.18_{ab}	22.02_{c}	19.21_{c}
Worry about AIDS	6.93_{a}	4.92_{ab}	5.29_{ab}	4.18_{b}	4.28_{b}
	Means Adjusted for Age				
Willing to interact	9.65_{a}	14.86_{b}	14.29_{b}	20.76_{c}	17.90_{bc}
Worry about AIDS	6.13	4.32	4.58	4.59	4.75

Cluster 1 = Magical Thinking
Cluster 2 = Reject True/No Clue
Cluster 3 = Drugs & Germs
Cluster 4 = Sex & Drugs/Not Blood
Cluster 5 = True Risks/Blood Myths